

In the Claims:

Claim 1 is amended as follows:

1. A method of establishing wireless communications between an interrogator and individual ones of multiple wireless identification devices, the wireless identification devices having respective identification numbers and being addressable by specifying identification numbers with any one of multiple possible degrees of precision, the method comprising utilizing a tree search in an arbitration scheme to determine a degree of precision necessary to establish one-on-one communications between the interrogator and individual ones of the multiple wireless identification devices, a search tree being defined for the tree search method, the tree having multiple selectable levels respectively representing subgroups of the multiple wireless identification devices, the level at which a tree search starts being variable the method further comprising starting the tree search at any selectable level of the search tree.

Claim 6 is amended as follows:

6. A method in accordance with claim 1 wherein the wireless identification device comprises an integrated circuit including a receiver, a modulator, and a microprocessor in communication with the receiver and modulator.

Claim 18 is amended as follows:

18. A method of addressing messages from an interrogator to a selected one or more of a number of RFID devices in accordance with claim 17 [16] wherein selecting the level of the tree comprises taking the base two logarithm of the determined maximum possible number, wherein a level of the tree containing all subgroups is considered level zero, and lower levels are numbered consecutively.

Claim 19 is amended as follows:

19. A method of addressing messages from an interrogator to a selected one or more of a number of RFID devices in accordance with claim 17 [16] wherein selecting the level of the tree comprises taking the base two logarithm of the determined maximum possible number, wherein a level of the tree containing all subgroups is considered level zero, and lower levels are numbered consecutively, and wherein the maximum number of devices in a subgroup in one level is half of the maximum number of devices in the next higher level.

Claim 20 is amended as follows:

20. A method of addressing messages from an interrogator to a selected one or more of a number of RFID devices in accordance with claim 17 [16] wherein selecting the level of the tree comprises taking the base two logarithm of the power of two nearest the determined maximum possible number, wherein the level of the tree containing all subgroups is considered level zero, and lower levels are numbered consecutively, and wherein the maximum number of devices in a subgroup in one level is half of the maximum number of devices in the next higher level.

Claim 24 is amended as follows:

24. A communications system comprising an interrogator, and a plurality of wireless identification devices configured to communicate with the interrogator in a wireless fashion, the wireless identification devices having respective identification numbers, the interrogator being configured to employ a tree search in a search tree having multiple selectable levels, to determine the identification numbers of the [different] wireless identification devices with sufficient precision so as to be able to establish one-on-one communications between the interrogator and individual ones of the [multiple] wireless identification devices,

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wherein the interrogator is configured to start the tree search at any selectable level of the search tree.

Claim 27 is amended as follows:

27. A system comprising:

an interrogator;

a number of communications devices capable of wireless communications with the interrogator;

means for establishing a predetermined number of bits to be used as random numbers, and for causing respective devices to select random numbers respectively having the predetermined number of bits;

means for inputting a predetermined number indicative of the maximum number of devices possibly capable of communicating with the interrogator [receiver];

means for causing the interrogator to transmit a command requesting devices having random values within a specified group of random values to respond, the specified group being chosen in response to the inputted predetermined number;

means for causing devices receiving the command to determine if their chosen random values fall within the specified group and, if so, send a reply to the interrogator; and

means for causing the interrogator to determine if a collision occurred between devices that sent a reply and, if so, create a new, smaller, specified

group.

Claim 34 is amended as follows:

34. A system comprising:

an interrogator configured to communicate to a selected one or more of a number of RFID devices;

a plurality of RFID devices, respective devices being configured to store unique identification numbers respectively having a first predetermined number of bits, respective devices being further configured to store a second predetermined number of bits to be used for random values, respective devices being configured to select random values independently of random values selected by the other devices;

the interrogator being configured to transmit an identify command requesting a response from devices having random values within a specified group of a plurality of possible groups [or] of random values, the specified group being less than or equal to the entire set of random values, the plurality of possible groups being organized in a binary tree defined by a plurality of nodes at respective levels, wherein the maximum size of groups of random values decrease in size by half with each node descended, wherein the specified group is below a node on a level of the tree selected based on the maximum number of devices known to be capable of communicating with the interrogator;

devices receiving the command respectively being configured to determine if their chosen random values fall within the specified group and, only if so, send a reply to the interrogator, wherein sending a reply to the interrogator comprises transmitting both the random value of the device sending the reply and the unique identification number of the device sending the reply;

the interrogator being configured to determine if a collision occurred between devices that sent a reply and, if so, create a new, smaller, specified group using a level of the tree different from the level used in previously transmitting an identify command, the interrogator transmitting an identify command requesting devices having random values within the new specified group of random values to respond; and

the interrogator being configured to send a command individually addressed to a device after communicating with a device without a collision.

Claim 35 is amended as follows:

35. A system in accordance with claim 34 wherein the interrogator is configured to input and store a [the predetermined] number representing the specified group.

38. A system comprising:

an interrogator configured to communicate to a selected one or more of a number of RFID devices;

a plurality of RFID devices, respective devices being configured to store unique identification numbers respectively having a first predetermined number of bits, respective devices being further configured to store a second predetermined number of bits to be used for random values, respective devices being configured to select random values independently of random values selected by the other devices;

the interrogator being configured to transmit an identify command requesting a response from devices having random values within a specified group of a plurality of possible groups of random values, the specified group being less than or equal to the entire set of random values, the plurality of possible groups being organized in a binary tree defined by a plurality of nodes at respective levels, wherein the maximum size of groups of random values decrease in size by half with each node descended, wherein the specified group is below a node on a level of the tree selected based on the maximum number of devices known to be capable of communicating with the interrogator;

devices receiving the command respectively being configured to determine if their chosen random values fall within the specified group and, only if so, send

a reply to the interrogator, wherein sending a reply to the interrogator comprises transmitting the unique identification number of the device sending the reply;

the interrogator being configured to determine if a collision occurred between devices that sent a reply and, if so, create a new, smaller, specified group using a level of the tree different from the level used in previously transmitting an identify command, the interrogator transmitting an identify command requesting devices having random values within the new specified group of random values to respond; and

the interrogator being configured to send a command individually addressed to a device after communicating with a device without a collision.

39. A method comprising:

using a tree search to determine an identification number of one of a plurality of wireless identification devices, an arbitration search tree being defined for the tree search; and

starting the tree search at a selectable level of the search tree.

40. The method of claim 39, wherein the selectable level is selected to be Level 1 or a level further down the search tree.

41. The method of claim 39, wherein the selectable level is selected to be Level 2 or a level further down the search tree.

42. The method of claim 39, further comprising skipping a level of the search tree during a tree search scheme.

43. The method of claim 42, wherein skipping the level is done in response to receiving a first reply from the one of the plurality of wireless identification devices and detecting a collision in the first reply.

44. The method of claim 43, wherein skipping the level is done after completing a traversal of a previous level in which the collision is detected.

45. The method of claim 43, wherein the first reply includes the identification number.

46. The method of claim 40, wherein the first reply includes an arbitration number of the one of the plurality of wireless identification devices.

47. The method of claim 39, further comprising using an Aloha scheme in combination with the tree search scheme to determine the identification number.

48. The method of claim 47, further comprising sending a plurality of signals from an interrogator, each of the plurality of signals indicating to the plurality of wireless identification devices a beginning of each of a plurality of slots associated with the Aloha scheme.

49. A computer-readable medium comprising instructions that, when executed, cause an interrogator to perform a method comprising:

transmitting a first request for identification, in accordance with an arbitration tree search, to a first subgroup of RFID devices associated with a first branch at a first level of a search tree; and

starting the tree search at a level other than levels 0 and 1 of the search tree.

50. The computer-readable medium of claim 49, wherein the method further comprises:

skipping a level of the search tree associated with the first branch; and
transmitting a second request for identification, in accordance with the
arbitration tree search, to a second subgroup of RFID devices associated with
the first branch at a second level of the search tree.

51. The computer-readable medium of claim 50, wherein skipping the
level is done in response to receiving a reply from the first subgroup of RFID
devices and detecting a collision in the reply.

52. The computer-readable medium of claim 51, wherein the method
further comprises transmitting a third request for identification, in accordance
with the arbitration tree search, to a third subgroup of RFID devices associated
with a second branch at a third level of the search tree, the third level of the
search tree being the level that was skipped associated with the first branch.

53. The computer-readable medium of claim 51, wherein the reply
includes an identification number or arbitration number.

54. The computer-readable medium of claim 49, wherein the method further comprises transmitting a command that causes the first subgroup of RFID devices to independently generate arbitration numbers associated with the search tree.

55. The computer-readable medium of claim 49, wherein the method further comprises transmitting an Aloha signal to the first subgroup of RFID devices, the Aloha signal associated with an Aloha scheme.

56. The computer-readable medium of claim 50, wherein the method further comprises transmitting an Aloha signal to the first subgroup of RFID devices, the Aloha signal associated with an Aloha scheme.

57. The computer-readable medium of claim 55, wherein the Aloha signal includes a marker to indicate a beginning of each of a plurality of slots associated with the Aloha scheme.

58. A method comprising:

affixing a RFID device to an object for tracking and to identify the object,
the RFID device to store an identification number;

sending a first signal from an interrogator to the object, the first signal
indicating a first subgroup at a first level of a search tree in accordance with a
tree search;

starting the tree search at a selectable level of the search tree;

determining the identification number stored in the RFID device; and

associating the identification number with the object.

59. The method of claim 58, wherein the selectable level is selected to
be Level 2 or a level further down the search tree.

60. The method of claim 58, further comprising selecting the selectable
level manually.

61. The method of claim 58, further comprising sending a second signal from the interrogator, the second signal indicating a second level of the search tree, wherein a level of the search tree is skipped between the first and second levels within the subgroup;

62. The method of claim 61, further comprising receiving a reply from the RFID device in response to the first signal, wherein sending the second signal is done in response to the reply.

63. The method of claim 58, wherein tracking includes determining the location, movement, or existence of the object.

64. The method of claim 58, further comprising sending a command that causes the RFID device to generate an arbitration number associated with the search tree.

65. The method of claim 58, further comprising sending a third signal from the interrogator, the third signal being associated with an Aloha scheme.

66. The method of claim 65, wherein the Aloha signal indicates a beginning and an end of a slot period of the Aloha scheme.

67. An interrogator comprising:
a transmitter circuit to send a first signal to indicate a first value and a first location associated with a first level of a search tree to a plurality of RFID devices; and

a receiver circuit to receive a reply signal indicating if a portion of an identification number associated with the first location is equal to the first value;
and

a selection circuit to determine a level of the search tree at which to start a tree search.

68. The interrogator of claim 67, wherein the selection circuit is responsive to manual input.

69. The interrogator of claim 67, further comprising a collision detection circuit to determine if there is a collision in the reply signal, the transmitter to send a second signal to indicate a second value and a second location associated with a second level of the search tree in response to the collision detection circuit detecting a collision, a level of the search tree being skipped between the first and second levels.

70. The interrogator of claim 67, further comprising a memory to store a value received from one of the plurality of RFID devices.

71. The interrogator of claim 70, wherein the memory is to store an arbitration number, and the interrogator is to address the one of the plurality of RFID device using the arbitration number.

72. The interrogator of claim 70, wherein the memory is to store an identification number, and the interrogator is to address the one of the plurality of RFID device using the identification number.

73. The interrogator of claim 69, wherein the transmitter circuit, in response to the collision detection circuit detecting a collision, is to further send a third signal, the third signal being associated with an Aloha scheme.

74. The interrogator of claim 73, wherein the third signal indicates a beginning and an end of a slot of the Aloha scheme.

75. A system comprising:
an interrogator to use a search tree in a tree search scheme to determine an identification number of each of a plurality of wireless identification devices,
the interrogator to skip a level of the search tree;
an object; and
a wireless identification device, responsive to the interrogator, affixed to the object to identify the object.